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SMALL ANIMAL NUTRITION

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IN GENERAL, the body needs daily intakes of a proper proportion of carbohydrate and fat for energy, amino acids for the synthesis of tissue proteins, and vitamins for special structures. In addition, it requires inorganic ions and water for the ionic environment, and inorganic elements such as iron, cobalt, manganese and copper, for organic combination. Thus, if dietary therapy emphasizes only one or two, or anything less than the whole group of ingredients needed daily, then the clinician is depending upon the body reserves to correct the deficiency. Similarly, a study of any particular ingredient such as the protein component must be done with a diet which supplies, to the best of our knowledge, all other essential ingredients.

THE BASAL DIET

Very little is known, however, concerning the nutritional requirements of the cat, probably because this household pet has thrived so well on diets derived from the family table and from the neighboring fields and woods. Restriction of the cat to a more limited diet, particularly through curtailment of supplementation through hunting, has created the need for an all-purpose ration for the cat and for more knowledge concerning the nutrition of this animal. Certainly the veterinarian is handicapped in the prevention and cure of illness in the cat by lack of this knowledge.

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CALORIC INTAKE

The Beagle puppy, for example, requires intially 200 or more calories/day/kg. of body weight. This requirement drops rapidly as the dog increases in age and size until a fairly constant intake of 80 to 90 calories/day/kg. of body weight is required for maintenance.

A Fox terrier, on the other hand, requires 100 or more calories/day/kg., so that caloric intake varies with the size, activity and species of the animal. The 160 calories/day/kg. required by young cats is relatively high. The caloric intake of the older cats was approximately 80 calories/day/kg.

AMINO ACIDS — PROTEINS

Many veterinarians are apparently of the opinion that if they are feeding protein, they are feeding amino acids. Protein does not yield amino acids until it is digested, and in the very cases that the veterinarian is treating, the assimiliation of intact protein by the system probably is impaired. Thus the amino acids are not being made available to the metabolic pool. The feeding of free amino acids insures their being immediately utilized, and apparently aids in the assimilation of the other intact protein.

Many veterinarians prescribe special protein diets when actually it is the amino acids that the dog needs. The dog's system must be able to absorb amino acids from the special protein diets, but in most cases, because of disease its ability to do so is diminished if not ceased. In other words it is necessary to turn protein consciousness into amino acid consciousness

with a little bio-chemistry. We have had reports from veterinarians that many dogs brought into the hospital with a poor hair coat and a general run-down condition including poor appetite, had been on special protein dog food. These veterinarians state they have taken these dogs off these special protein dog foods, feeding them their regular dog ration adding amino acids. In a short time the body weights were normal, appetite excellent, and they developed a glistening hair coat.

Taber's Medical Dictionary defines "protein" as: "One of a class of nitrogenous compounds which occur naturally, give amino acids when hydrolyzed, and are essential to all living organisms."

The important words here are: "give amino acids when hydrolyzed." They are not emphasized in the dictionary. The reason for emphasis here is that the difference between proteins and amino acids has been so long ignored that they are often assumed to be the same thing. This is like assuming that chunks of an old chimney, containing bricks strongly united by mortar, are just as good building material as clean and separate bricks. And the result of this error in corrective practice is often disastrous.

Proteins are built of the "bricks" called "amino acids," but the latter are not available for biological use until they have been broken apart from their protein bonds, so that they become again basic building units. This breaking apart is done, in the animal body, by a process called "hydrolysis." This work literally means a dissolving in water, but as the biochemical forces of the body handle it, the process is not as simple as that. In the stomach they are subjected, after about an hour's delay, to the force and energy of gastric juice, which is strongly acid. Gastric juice carries also an enzyme, pepsin, which speeds up the dissolving force of HCl, the acid.

The point to keep in mind at this time is that before the bricks called "amino acids" can be used in the body for building specific proteins, such as heart or muscle or glandular tissue, they must be broken apart from their old structures—such as beefsteak or hard boiled eggs. They must be "hydrolyzed." When and if this process takes place, the biochemical units from which specific proteins can be put together pass through the intestinal walls into the general circulation. Some of them go directly to the liver, where they are held, perhaps broken down into a carbohydrate moiety and used for forming glycogen and a free nitrogen radical which is excreted. Or the liver may use its share of the amino acids for synthesizing its own enzymes. The amino acids which go past the liver eventually reach the other tissues, organs, cells, and are selected out and used for building cells, enzymes, hormones, etc. But first of all, in the digestive tract, the hydrolysis must have taken place successfully.

Proteins which by some mischance get into the general circulation unchanged — as proteins — are highly toxic. Snake venom is a "foreign protein," injected into the blood stream directly and unchanged — not hydrolyzed. Sometimes a protein fragment gets into the circulation unchanged, from the digestive tract. One effect of such unhydrolyzed proteins is an allergy. But there is another possibility. Because of a failure of sufficient enzymic assistance, proteins may pass on through the intestinal canal and be eliminated. The body has not been able to break them down.

It is the amino acids that perform the various functions usually ascribed to proteins. Here are some of the functions amino acids, as such, perform: they enable the liver to convert various forms of lipids — fats, oils, steroids — into phospholipids and lipoproteins; methionine, an amino acid, plus other separate or hydrolyzed amino acids, "maintain the architectural integrity of the liver cells." In other words, they enable liver cells to perform their functions without being damaged by the by-products of their own activities.

Amino acids play a major role in converting the various fats and oils into useful products, and in conveying these

products by way of the blood to the body cells that need them. One authority states that, "It is probable that most metabolites are parts of protein complexes at the time they are metabolized." This means that various separate amino acids are mixed into a temporary biochemical compound for transit, etc. Lack of an essential amino acid can block this function.

Eaton et al. (1951) reported on the inhibition of virus infection by addition of certain amino acids. Thus, lysine, arginine, and tryptophane have been proved effective in preventing virus multiplication on the virus group causing damage to the central nervous system. It is presumed that the good results reported by the veterinarians in treating early viral diseases in animals is due to actual blocking of the growth of the virus particles inside the cells.

Where practical, most authorities now believe that oral administration of amino acids will certainly benefit the animal or patient more than intravenous use. Mulholland et al. (1952) demonstrated that intravenously injected amino acid mixtures are eliminated largely into the urine in the form of amino nitrogen, urea, or other end products. We recommend that an amino acid concentrate be given orally or by slow intravenous drip therapy.

Veterinarians whom we have contacted after having used an amino acid concentrate for several months are unamimous in their reports of its superior action.

A veterinarian in Iowa was dubious of any claims of therapeutic results, so he set up a clinical testing program whereby litters of puppies were divided — half of the puppies receiving their regular ration — the other half receiving the same ration plus the recommended dosage of an amino acid concentrate. This veterinarian, after several months, has reported a very significant increase in the rate of growth of those puppies receiving the amino acid concentrate.

FAT AND NUTRITION OF THE DOG

In an attempt to determine the role of dietary fat, experimental animals have been maintained on regimens containing various amounts and kinds of fat. In the work reported herein, the dog has been used as the experimental animal inasmuch as it was felt that periodic lipid analyses of the blood and tissues were essential for correlation with any gross changes which might develop using the various diets.

In the experimental work with dogs it was soon learned that the most marked effect of a diet low in fat was manifested by changes in the hair and skin of the animals. The alterations developed much sooner in young puppies than in adult dogs. Hence, it was found advantageous to start with puppies at the time of weaning or shortly thereafter. Mongrel puppies which had been freed from intestinal and skin parasites were housed in a separate wire cage.

The basic low fat diet has the following caloric composition:

The ingredients used to provide 100 calories were:

Protein (casein, skim milk powder)	23.6%
Carbohydrate (sucrose)	75.5%
Fat (milk fat)	0.9%
Casein	4.5 gm.
Skim milk powder	5.0 gm.
Sucrose	15.0 gm.

Sufficient water to give a palatable mixture was added to the dry ingredients.

The gross changes in the appearance of young puppies maintained on a diet containing 1 per cent of its calories as fat are characterized first by dryness of the skin and hair, followed by a fine desquamation which becomes progressively severe with extensive loss of hair. There may be numerous small areas of infection, some impetigo-like in character, on the ventral surface, back of the ears and on the dorsal surface of the skin. At this stage, apparently there is considerable itching as evidenced by scratching. The desquamation becomes increasingly severe so that large areas of epidermis can be peeled off and the paws are reddened, edematous and often show oozing between the toes.

Frequently, a purulent discharge exudes from the ear canals. Gradually, there is generalized redness of the skin, marked alopecia and emaciation. When alopecia occurs, the skin often appears

and feels greasy. Dryness of the hair and a fine flakiness of the skin will be evident in about three months but the alopecia, edema and emaciation may not appear for one to two years. When animals are on the fat deficient diet for prolonged periods, they go through cycles in which there is extensive desquamation with almost complete loss of hair followed by a period in which the desquamation is decreased markedly and new hair appears. Changes in the appearance of the skin and hair have been noted with animals both in a temperate and semi-tropical climate and under various degrees of humidity. Severe alopecia and emaciation were not observed in the temperate climate. Part of this difference may be dependent on the previous history of those animals. However, all of the marked dermatologic effects have been observed in a humid climate. In addition to the abnormalities of the hair and skin all the dogs have shown a change in temperament. First, they become very excitable and later tremulous. Some of the animals appear to succumb quite readily to infection.

Young puppies maintained on fat intakes of 1 to 6 percent of the total calories develop abnormalities of the skin and hair whereas when fresh lard is fed at a caloric level of 29 percent (total fat 30 percent), such abnormalities are prevented. Consequently, the curative effect of fat in restoring healthy appearing skin and hair to fat deficient animals was tried at various levels of intake.

The emaciation observed in the fat deficient animals possibly may be attributed to poor utilization of the carbohydrate and protein resutling from the absence of fat in the diet.

Although death may not occur as a result of a lack of dietary fat, marked abnormal changes in the gross appearance of the skin and hair take place. The major changes which developed are characterized by dryness of the skin and hair, desquamation, loss of hair and increased susceptibility to infection. Mortality in the fat-deficient animals was 38 percent. The syndrome was prevented and cured by the incorporation in the diet of 29 percent of the calories as fresh lard, bacon fat drippings, butterfat or crisco (total calories as fat 30 percent). Marked improvement was produced when the fat level was increased to 6, 11 or 16 percent of the calories. However, complete and permanant cures were not observed at levels less than 16 per cent. Incorporation of one percent of the calories as linoleic or arachidonic acid ester also resulted in definite improvement in the skin and renewed growth of hair. This level of unsaturated fatty acid alone was not sufficient to effect complete and permanent cures in a period of six months.

In summary, although the small animal in the United States receives much better nutrititon than heretofore, it is proposed that at least 50 percent of these animals are still suffering from various forms of nutritional deficiencies. Much more work needs to be done to supply the knowledge necessary to prevent nutritional disorders in these animals.

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PUBLIC RELATIONS

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They do not give the characteristic pauses and groupings of extemporaneous talk. They read too regularly. The words on the paper just pull them along at a monotonous and usually too fast a rate. I have found, particularly on such a program as ours, that I could more easily simulate ordinary conversation if I deliberately stopped in the middle of sentences and continued with a different inflection in my voice. However, this is a matter to be determined by the individual.

In conclusion, I would like to say that what was done on behalf of Colorado veterinarians can be done anywhere in the United States, and perhaps is already being accomplished in many areas. I have no illusions that what we did here was unique nor is it at all impossible. We make no apologies for the fact that our radio program was not a professional effort. We are extremely proud of the fact that it contributed greatly to the public relations effort of the veterinary profession and brought us much closer to the public which we serve.

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